

[0044] An adjustable tint layer (sometimes referred to as a light modulator layer or adjustable color layer) may be formed from a light modulator component such as an electrochromic device, guest-host liquid crystal device, a suspended particle device, or other suitable electrically adjustable tint layer. Light absorption and/or color (in transmission and/or in reflection) can be adjusted using the adjustable tint layer.

[0045] An electrochromic device may have a pair of transparent electrodes. An electrolyte such as LiNiOP (e.g., a gel electrolyte) may be interposed between electrochromic coatings on the electrodes. The electrochromic coatings may be, for example, a Li_xNiO coating on a first of the electrodes and a WO_3 coating on a second of the electrodes. The electrodes may be used to apply a current to the electrochromic coatings to either darken (color) or lighten (discolor) electrochromic layer. Electrochromic devices may exhibit low haze (e.g., less than 5%) and may maintain their current state in the event of a failure. If desired, a tint layer for adjustable decoration 40 may be implemented using a solid state electrochromic device in which solid organic or inorganic material is used to form the electrochromic electrolyte.

[0046] A guest-host liquid crystal device may include a light-absorbing dye “guest” in a liquid crystal “host” layer. These materials may form a layer that is sandwiched between a pair of transparent electrodes. When an electric field is applied to the guest-host layer, the liquid crystals rotate, thereby rotating the guest dye into an orientation that enhances light absorption. When the electric field is removed, the guest dye molecules are no longer held in the high-absorption orientation so that layer becomes transparent. The guest-host layer may vary between transparent and opaque. Partially transparent states may also be exhibited (e.g., at intermediate electric field values). In some states (e.g., non-transparent states), the guest-host layer may exhibit a color cast (e.g., a color associated with the guest dye).

[0047] Layers 40' may also include an adjustable tint layer implemented using a suspended particle device. A suspended particle device contains a layer of nanoparticles suspended in a liquid that is sandwiched between substrate layers with transparent conductive electrodes. In the absence of an applied electric field, the nanoparticles are randomly oriented and absorb light (i.e., the tint of the adjustable tint layer is dark). When an electric field is applied, the nanoparticles align and allow light to pass (i.e., the tint of the layer is clear). In addition to allowing an adjustable tint to be obtained, suspended particle devices are characterized by an associated adjustable haze (e.g., a 6% haze when the suspended particle device is off and is exhibiting a low amount of light absorption and a 50% haze when the suspended particle device is on and is exhibiting a high amount of light absorption). In this way, a suspended particle device may serve both as an adjustable tint layer and as an adjustable haze layer.

[0048] In some arrangements, layers 40' may include an adjustable reflectivity layer. An adjustable reflectivity layer for adjustable decoration 40 may be formed from an adjustable reflectivity component such as a cholesteric liquid crystal layer. A cholesteric liquid crystal device may exhibit a mirror reflectivity that is adjustable. When used in adjustable decoration 40, the cholesteric liquid crystal device may be characterized by an “on” state and an “off” state. In the

“on” state (e.g., when control circuitry 32 applies a voltage to the cholesteric liquid crystal device), the cholesteric liquid crystal device may be transparent. The transmission of the cholesteric liquid crystal device may be adjusted by adjusting the applied voltage (i.e., a cholesteric liquid crystal layer may serve both as an adjustable reflectivity layer and as an adjustable tint layer). In the “off” state, the cholesteric liquid crystal device may act as a partial mirror and may reflect more than 50% of incident light, more than 70% of incident light, less than 99% of incident light, or other suitable amount of incident light.

[0049] Cholesteric liquid crystal layers may exhibit relatively fast switching speeds, low haze (e.g., haze values of less than 5%), and good reflectivity (e.g., when “off”). If desired, adjustable reflectivity layers may be implemented using other types of adjustable mirror components. For example, an adjustable reflectivity component for adjustable decoration 40 may be formed from a solid-state switching mirror component based on a switchable metal hydride film (e.g., adjustable decoration 40 may include an adjustable magnesium hydride mirror layer).

[0050] If desired, haze may be adjusted using an adjustable haze layer in layers 40'. An adjustable haze layer may be implemented using a polymer-dispersed liquid crystal device. In this type of device, a polymer layer having voids filled with liquid crystal material may be sandwiched between conductive transparent electrodes on respective first and second transparent substrates. When no electric field is applied to the electrodes, the liquid crystals in the voids are randomly oriented and exhibit an index-of-refraction difference with the surrounding polymer layer. This causes the liquid crystal material of the voids to produce a relatively large amount of haze that scatters light that is passing through the polymer layer. When electric field is applied to the electrodes by control circuitry 32, the liquid crystals of the liquid crystal material in the voids becomes aligned so that the liquid crystal material in the voids exhibits an index of refraction that matches the surrounding polymer. In this configuration, the adjustable haze layer exhibits low haze and high transparency. Intermediate haze levels may be achieved by applying an electric field at an intermediate level.

[0051] In addition to incorporating one or more of these adjustable optical layers in layers 40' of adjustable decoration 40, one or more fixed optical layers 40' may be incorporated in adjustable decoration 40. Layers 40' may, for example, be implemented using fixed reflectivity layers (e.g., thin reflective metal coatings, thin reflective dielectric stack coatings, etc.), fixed tint (e.g., glass or polymer that has been darkened by incorporation of light-absorbing particles, dye, metal coating material, etc.), and/or fixed haze (e.g., by incorporating a textured polymer or glass layer, a hazy layer formed from microbubbles or light-scattering particles in a glass or plastic material, etc.). In general, any type of adjustable layer that exhibits an adjustable appearance can be incorporated into decoration 40. The use of adjustable layers in providing adjustable decoration with adjustable optical characteristics (e.g., adjustable appearance characteristics) using layer(s) with adjustable tint, haze, and/or reflectivity is illustrative.

[0052] An example of structure that may be used as a fixed decoration layer is shown in FIG. 8. Layer 68 of FIG. 8 may be a solid layer of metal, polymer (e.g., polymer with pigment, dye, and/or other colorant and/or clear polymer),